W. I. A. — 5. Issued August 28, 1915.

United States Department of Agriculture,

BUREAU OF PLANT INDUSTRY,

Western Irrigation Agriculture,

WASHINGTON, D. C.

THE WORK OF THE SAN ANTONIO EXPERIMENT FARM IN 1914.

By S. H. Hastings, *Farm Superintendent.*

INTRODUCTION.

The season of 1914 was a particularly favorable one for crop production in the San Antonio region. Unusually heavy rains during the fall of 1913 filled the soil with moisture to an extent greater than for many years. While the rainfall for 1914 was nearly 5 inches less than in 1913, the crop yields of the experiment farm and in the San Antonio region generally were in the main larger than the previous year. Exceptionally heavy yields of corn and forage crops were obtained. The spring was rather cool and wet, especially during the months of April and May, and some difficulty was experienced in getting satisfactory stands of milo and cotton, which made the crops somewhat later than usual. It was necessary to replant both these crops on the experiment farm, and milo came into flower so much later than usual that the midge damage was more severe than at any time since this crop has been grown in the rotation experiments. The prospects were favorable for a heavy yield, but the final result gave an average yield of 39 bushels per acre, or nearly 9 bushels less than in 1913.

Very little fruit was obtained at the experiment farm, as a killing frost occurred on March 23, which severely injured the fruit crop, doing practically no damage, however, to other crops. Exceptionally satisfactory results were obtained in the experiments with cotton in testing the single-stalk method of growing the crop. In the experiments with milo, where the rows were spaced various distances apart and the distance between the plants was varied, very striking results were obtained, which confirmed the results obtained last season, i. e., that the plants should be spaced much closer together in the row than has been the general practice.

The variations in the results from the rotation and tillage experiments continue to be very pronounced, though not always significant. Over 1,400 pounds of seed cotton were obtained from two of the plats where manure was applied. One plat of corn gave a yield of 73 bushels per acre. The incorporation of the Canada field peas as a

green-manure and hay crop has given excellent results, and this appears to be a most desirable legume for use in this region. Good yields were obtained with Sudan grass, and while the yields were somewhat lower than from sorghum similarly planted, the finer quality of the hay and the ease with which it is cured indicates that when its value becomes known by the farmers Sudan grass will be very extensively grown.

The arrangement of the experiment farm fields and the location of the various crops of the year are shown in figure 1.

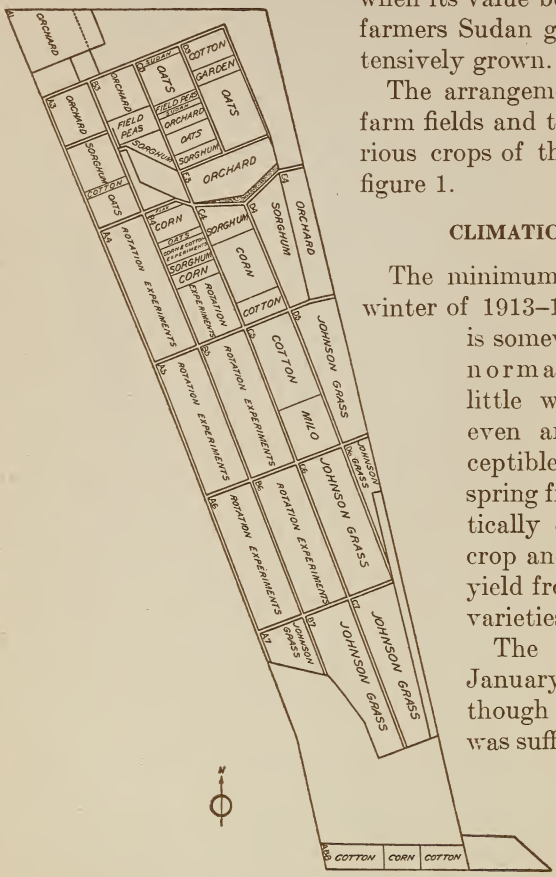

FIG. 1.—Diagram of the San Antonio Experiment Farm, showing the arrangement of the fields and the location of the experiments in 1914. (P-5647-W. I. A.)

CLIMATIC CONDITIONS.

The minimum temperature for the winter of 1913–14 was 21° F., which is somewhat higher than the normal. (Table I.) Very little winterkilling resulted, even among the more susceptible perennials. The late spring frost of March 23 practically destroyed the peach crop and severely affected the yield from many of the plum varieties.

The precipitation during January and February, though much below normal, was sufficient to keep the surface soil in good condition, and when planting time arrived the soil was in excellent tilth. The precipitation during March was somewhat below normal, and for April and May much above normal. The total precipitation for the months of April and May was 12.51 inches. A drought lasting several weeks occurred during June and July, the precipitation for these two months being very light. The abundance of moisture during April and May, however, minimized the effect of the drought, and in spite of scant precipitation in June a record crop of Indian corn was produced on the experiment farm.

The cotton plants grew to large size, and the dry weather during June helped to hold in check the ravages of the Mexican cotton boll

weevil, though the insects were very numerous early in the season. As a consequence, a high yield of cotton was obtained.

TABLE I.—*Summary of meteorological observations made at the San Antonio Experiment Farm, 1907 to 1914, inclusive.*

PRECIPITATION (INCHES).

Item.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Average for 8 years, 1907 to 1914	0.56	2.10	1.75	3.29	2.98	1.47	1.19	1.79	2.27	2.94	2.92	2.12	25.37
For 1914	.20	1.43	1.33	6.08	6.62	.04	0	4.28	1.87	3.89	4.20	1.43	31.37

EVAPORATION (INCHES).

Average for 8 years, 1907 to 1914	2.72	3.06	4.46	5.57	6.60	8.36	9.40	9.06	7.14	5.15	2.98	2.33	66.83
For 1914	2.72	2.35	3.93	4.89	4.37	7.55	9.80	7.72	8.03	4.40	2.65	2.09	60.50

DAILY WIND VELOCITY (MILES PER HOUR).

Highest:													
1911–1914	10.4	15.9	9.1	10.6	9.2	11.9	12.1	12.1	6.6	8.5	9.5	8.0	15.9
For 1914	6.4	7.2	6.9	8.0	4.8	5.6	5.1	5.1	5.9	6.2	5.0	6.0	8.0
Lowest:													
1911–1914	.5	.1	.6	.4	.6	.8	.9	.5	.4	.4	.4	.3	.1
For 1914	.5	.1	.6	.9	.6	.8	.9	1.1	.4	.4	.6	.3	.1
Average:													
1911–1914	3.5	4.4	4.0	3.8	3.8	3.8	4.2	3.6	3.1	3.0	2.6	2.7	3.5
For 1914	2.1	2.9	3.4	2.9	2.3	2.5	2.4	2.6	2.4	2.3	1.9	2.4	2.5

TEMPERATURE (°F.).

Absolute maximum:													
1907–1914	88.5	87.0	95.0	102	103	108	108	105	104	98	86.5	82	108
For 1914	83.5	80.5	82	91	92	98.5	103.5	104	98	95	82	77	104
Absolute minimum:													
1907–1914	12	13	26	32	39	56	64	64	41	29	15	17	12
For 1914	22	22	26	32	55	65	67	69	52	40	31	21	21
Mean:													
1907–1914	53.5	53.8	63.1	67.9	75	82.2	85.1	84.9	79.7	69.4	60.4	49.6	68.7
For 1914	53.3	52.0	56.8	65.3	73.9	81.5	85.4	83.1	79.8	70.0	59.0	44.0	67.0

KILLING FROSTS.

Year.	Last in spring.		First in autumn.		Frost-free period.
	Date.	Minimum temperature.	Date.	Minimum temperature.	
		° *F.*		° *F.*	*Days.*
1907	Feb. 8	29.0	Nov. 12	32.0	277
1908	Feb. 20	24.0	Nov. 14	29.0	268
1909	Feb. 25	30.0	Dec. 6	31.0	284
1910	...do.....	26.0	Oct. 29	32.0	246
1911	...do.....	29.0	Nov. 13	31.0	261
1912	Feb. 27	30.5	Nov. 2	29.5	245
1913	Mar. 17	26.0	Oct. 27	29.0	224
1914	Mar. 23	29.0	Nov. 20	31.0	242

The precipitation during August was the heaviest, with one exception, ever recorded by the United States Weather Bureau at San Antonio. Timely rains fell during September and October. The yields of sorghum and other forage crops were all very good, three

cuttings being secured from the sorghum and Sudan grass in the rotation experiments.

Although the precipitation during November and December was not greatly in excess of the normal, much rainy weather occurred, which delayed the curing of late-cut forage crops, as well as other fall work.

During the year, the total precipitation at the experiment farm was 31.37 inches, which is 6.70 inches above the average for 1907 to 1914, inclusive, and about 4.54 inches above the normal precipitation at San Antonio as determined by the United States Weather Bureau.

The total evaporation was 60.5 inches, as compared with an average of 66.84 inches for the years 1907 to 1914, inclusive.

On the morning of March 23, the minimum temperature recorded was 31° and on March 24, 29.5° F. This was five days later than the last killing frost in 1913. This frost resulted in freezing the corn to the ground. New growth started up from the roots, however, and it was not necessary to replant the crop. The first killing frost in autumn occurred on November 20, when the minimum temperature was 31° F. This resulted in killing the more tender crops to the ground. The frost-free period in 1914 was 242 days.

The meteorological observations made at the experiment farm are carried on in cooperation with the Biophysical Laboratory of the Bureau of Plant Industry. Table I gives a summary of these observations for 1914, together with the means for the 8-year period from 1907 to 1914, inclusive.

ROTATION EXPERIMENTS.[1]

The rotation experiments were continued along the same lines as those outlined in previous reports. No changes or additions of consequence were made during the season. One plat was added to the experiments. This plat is to be cropped continuously to sorghum and manured annually. It was added in order to have a plat for direct comparison with plats continuously cropped to sorghum without manure.

The treatment in rotation A6–D, which is a 2-year rotation of corn and milo, was changed from plowing and subsoiling in July after the milo to plowing after the removal of the second crop of milo, the subsoiling being omitted. This change was made for the reason that there was no object in the subsoiling, since no other plats with a similar treatment were available for comparison, and it was desired to have one plat of milo which is allowed to grow from the stubble, in order to determine with what frequency a second crop of milo could be made. As had been planned, Sudan grass was substituted for oats in rotation A6–F, and the first crop of Sudan grass was grown in this rotation in the present season.

[1] This work was under the direct charge of Mr. C. R. Letteer, assistant.

For the most part, the yields obtained from the rotation experiments in 1914 were satisfactory. Difficulties in securing stands of some crops caused inconvenience early in the season, making some replanting necessary. Much trouble was experienced in securing a stand of milo. By replanting, a reasonably good stand of plants was secured, but the lateness of the crop and consequent injury by the sorghum midge resulted in low yields from these plats.

The yields of corn, of sorghum in 8-inch drills, of Sudan grass, and of cotton were the highest obtained during the six years the rotation experiments have been under way. Table II gives the crops grown in the rotation experiments, the number of plats planted to each crop, and the highest, lowest, and average yields per acre in 1914, as well as the average yields of the various crops for the 5-year period from 1909 to 1913, inclusive.

TABLE II.— *Yields per acre of crops in the rotation experiments at the San Antonio Experiment Farm, 1909 to 1914, inclusive.*

Crop.	Unit of yield.	Average yield, 1909 to 1913, inclusive.	Number of plats, 1914.	Yield in 1914.		
				Highest.	Lowest.	Average.
Corn	Bushel	19.5	21	73.1	29.4	52.6
Dwarf milo	do	[a] 43.9	14	52.6	9.7	39.0
Oats, grain	do	11.5	8	24.8	4.3	15.7
Cotton	Pounds	535.1	30	1,444.0	412.0	783.7
Sorghum:						
4.1-foot drills	Tons	3.78	5	7.8	4.5	6.46
8-inch drills	do	3.41	7	11.0	8.7	10.26
Sudan grass	do	[b] 5.3	2	8.2	7.2	7.7
Oats, hay	do	1.56	8	2.2	.78	1.33

[a] 1912 and 1913. [b] 1913 only.

VALUE OF ROTATION.

Although the rotation experiments have not been carried on for a sufficient time to permit the drawing of definite conclusions, the results so far obtained give some indications of value. The experiments were so planned that one or more plats have been used for continuous cropping to each of the important crops grown in the rotations. Since the experiments are comparatively new and the 3-year and 4-year rotations have gone through only one cycle, the results from the 2-year rotations only will be noted at this time. In Table III are shown the yields of crops when grown continuously on the same plats compared with the yields of the same crops when grown in 2-year rotations with other crops, the method of tillage being the same in both cases.

It is shown in Table III that when crops grown in 2-year rotations are compared with the same crops grown continuously on the same plats, higher yields have been obtained on account of the simple fact of rotation, except in two instances, i. e., where cotton follows sorghum.

TABLE III.—*Five-year average yield per acre of crops grown in 2-year rotations and under continuous cropping, San Antonio Experiment Farm.*

Crop.	Unit of yield.	In rotation with—		Continuous cropping yield.	Difference in favor of 2-year rotation.
		Crop.	Yield.		
Corn	Bushels.	Cotton	34.6	22.3	12.3
Do	do	Oats	34.2	22.3	11.9
Do	do	Sorghum [1]	24.4	22.3	2.1
Do	do	do [2]	26.4	22.3	4.1
Average	do		29.9	22.3	7.6
Cotton	Pounds.	Corn	649.0	554.0	95.0
Do	do	Sorghum [1]	471.0	554.0	−83.0
Do	do	do [2]	466.0	554.0	−88.0
Average	do		529.0	554.0	−25.0
Oats, hay	Tons	Corn	2.0	1.6	0.4
Dwarf milo	Bushels.	do	38.8	26.1	12.7
Do	do	Oats	34.4	26.1	8.3
Do	do	Cotton	37.5	26.1	11.4
Average	do		36.9	26.1	10.8
Sorghum [1]	Tons	Corn	5.40	4.68	.74
Do	do	Cotton	5.13	4.68	.46
Do [2]	do	Corn	5.62	4.32	1.62
Do	do	Cotton	5.48	4.32	1.16
Average	do		5.39	4.5	.89

[1] Sorghum in 4.1-foot drills. [2] Sorghum in 8-inch drills.

MANURING.

The effect of barnyard manure has been tested in ten of the rotations. Wherever manure has been used it has been applied at the rate of about 16 tons per acre. In four cases it was applied preceding corn, in five preceding cotton, and in one preceding milo.

The effect of manuring on the various crops for the five years from 1910 to 1914, inclusive, is summarized below. In this summary comparisons are made between rotations in which the treatments have been exactly the same except for the applications of manure.

(1) The effect on corn.
Corn continuously, 5 years, a gain of 3.3 bushels per acre.
Corn continuously, 2 years, a gain of 3 bushels per acre.
Corn in a 2-year rotation with oats, a loss of 0.8 bushel per acre.
Corn in a 2-year rotation with oats, a loss of 3 bushels per acre.
Corn the second year after manure, following cotton, a loss of 1.2 bushels per acre.

(2) The effect on cotton.
Cotton continuously, 5 years, a gain of 53 pounds of seed cotton.
Cotton in a 2-year rotation with corn, a gain of 125 pounds of seed cotton.
Cotton in a 4-year rotation, a gain of 59 pounds of seed cotton per acre.

(3) The effect on milo.
Milo continuously, 3 years (the plat having been manured for corn two years previously), a gain of 21.5 bushels per acre.
Milo in a 3-year rotation, 2 years, a gain of 4.9 bushels per acre.

(4) The effect on oats.
Oats following cotton that was manured showed a loss of 1.8 bushels per acre.

The effect of manure on crop yields at San Antonio under the conditions during the years 1910 to 1914 have not been consistently significant. The yields of cotton, corn, and milo have generally been slightly increased by manuring. The increases, however, have not been sufficient as yet to justify the expense of the treatment. Manure has caused a slight decrease in the yield of oats following manured cotton.

The effect of manure has been somewhat variable from year to year, in some years the yield of certain crops being increased and in other years slightly decreased. In 1914 manuring resulted in a marked increased yield of cotton and milo and had practically no effect on the yield of oats and corn. The average yield of cotton from three rotations where manure was applied preceding the cotton was 960 pounds

FIG. 2.—Lone Star cotton on plat B6–9. This plat gave a yield of 1,388 pounds of seed cotton per acre. It received an application of barnyard manure the previous fall, and a crop of Canada field peas was grown during the winter of 1913–14 and plowed under in the spring. Photographed August 28, 1914. (P–5172–W. I. A.)

of seed cotton per acre, as compared with 735 pounds as an average from three similar rotations not manured, a difference of 225 pounds of seed cotton per acre. The greatest increase in yield due to manuring was from plats B6–5, B6–7, and B6–9. Plat B6–5 yielded 1,444 pounds of seed cotton per acre, as compared with 918 pounds of seed cotton per acre from plat B6–1 in a similar rotation not manured. Plats B6–7 and B6–9 are in similar rotations to B6–5, but Canada field peas were grown as a winter cover crop and plowed under in the spring preceding the planting of cotton. Figure 2 shows the growth of cotton on plat B6–9 in 1914.

The average yield of Dwarf milo from two rotations in which manure was applied immediately preceding the milo was 47.9 bushels

per acre, as compared with 27.1 bushels per acre from similar rotations not manured. The average yield of corn from three rotations in which manure was applied immediately preceding the corn was 50 bushels per acre, as compared with 50.2 bushels per acre from similar rotations not manured.

EXPERIMENTS WITH COTTON.

An extensive series of experiments was conducted in testing the value of the single-stalk method[1] of growing cotton. This test was carried on in cooperation with the Office of Crop Acclimatization and was in charge of Mr. R. M. Meade, of that office.

The Acala variety, recently acclimatized from Mexico, was used in these experiments.

Alternate row and alternate block comparisons were made between the new method and the one generally used by cotton growers. In half of the test 20 rows with the plants thinned early and wide spaced alternated with 20 rows with the plants thinned later and left closer together. In the other half five 4-row blocks of early-thinned wide-spaced plants alternated with five 4-row blocks of late-thinned close-spaced plants.

Wide-spaced rows were thinned when the plants were 3 or 4 inches high and had two or three leaves in addition to the seed leaves, and the plants were left as nearly as possible 2 feet apart in the row. The plants in the close-spaced rows were thinned when the plants had seven or eight leaves and were from 10 to 12 inches high, and the plants were left 6 to 8 inches apart.

In the alternate-row section the yields from wide-spaced rows ranged from 9 to 14.4 pounds per row, while the yields from alternating close-spaced rows ranged from 17.6 to 31 pounds per row. The lowest yield from the close-spaced rows was 22 per cent greater than the highest yield from the wide-spaced rows. The total yields from 20 wide-spaced rows and 20 close-spaced rows in this alternate-row test were 242 pounds and 535 pounds, respectively, the close-spaced rows yielding 121.5 per cent more than the wide-spaced rows.

In the alternate blocks the yields of single rows ranged from 10.3 to 17 pounds and from 17.2 to 24.6 pounds, respectively, for the wide-spaced and close-spaced rows. Here, the highest yield from a wide-spaced row practically equaled the lowest yield from close-spaced rows. The total yield for the five blocks of four rows each was 272.8 pounds and 425.8 pounds, respectively, for wide-spaced and close-spaced rows, an increase of 56.1 per cent due to late thinning and closer spacing.

The inside rows of the blocks more closely represent conditions that would obtain under field culture than is the case in alternate rows,

[1] Cook, O. F. Single-stalk cotton culture: U. S. Department of Agriculture, Bureau of Plant Industry [Misc. Pub.] 1130, 11 p., 12 figs., 1914.

and these inside rows should be compared to show the real increase that might be expected under field conditions. Inside rows of close-spaced blocks yielded 48 per cent more seed cotton than inside rows of wide-spaced blocks.

In all cases the close-spaced rows gave higher yields than adjoining rows in which the plants were wide spaced, the range of increase being from 88 to 125 per cent in favor of the close-spaced rows.

TIME-OF-THINNING TESTS.

A time-of-thinning test containing three blocks of five rows each was conducted with Acala cotton. One block was thinned 25 days, another 41 days, and the third 51 days after planting. The plants in the rows within a block were left at about 6, 9, 12, 18, and 24 inches apart. The cotton was planted April 14. Table IV gives the results of the tests.

TABLE IV.— *Yields of Acala cotton in rows 4 feet apart and 264 feet long, thinned to different distances on different dates, at the San Antonio Experiment Farm in 1914.*

Distance between plants.	Thinned 25 days after planting.		Thinned 41 days after planting.		Thinned 51 days after planting.	
	Plants in row.	Total yield.	Plants in row.	Total yield.	Plants in row.	Total yield.
		Pounds.		*Pounds.*		*Pounds.*
6 inches	320	21.8	321	20.8	423	17.4
9 inches	271	20.6	294	19.7	281	17.1
12 inches	167	14.7	273	18.2	256	18.7
18 inches	148	13.7	163	16.2	200	17.8
24 inches	138	11.4	160	16.7	160	15.8

Unfortunately, these yields were obtained from only a single row in each case, so that too much dependence should not be placed upon them. They indicate, however, that whether the plants are thinned early or late, close spacing is more favorable than wide spacing.

DISTANCE-BETWEEN-ROW TEST.

Rows were planted 3, 4, 5, and 6 feet apart in about one-sixth acre blocks containing, respectively, 8, 6, 5, and 4 rows. A guard row separated each block from its neighbor. Rows with plants early thinned and wide spaced alternated with rows with plants late thinned and close spaced, so that the two systems of culture might be readily compared. Table V records the results of the test.

TABLE V.— *Yields of Acala cotton in wide-spaced and close-spaced rows 264 feet long, at the San Antonio Experiment Farm in 1914.*

Distance between rows.	Wide-spaced rows.	Close-spaced rows.	Increase of close-spaced rows.
	Pounds.	*Pounds.*	*Per cent.*
3 feet	393	802	104.0
4 feet	463	872	88.5
5 feet	425	825	95.0
6 feet	362	816	125.0

The standard distance between the rows at the experiment farm is 4 feet and it will be observed that this distance gave the highest yield in both instances.

EXPERIMENTS WITH MILO.

Demonstrations have been continued to show the effect on the tillering, branching, uniformity, date of ripening, and yield of grain[1] of milo by planting in rows at different distances apart and thinning the plants to different distances apart in the row. The summary of results may be stated as follows:

(1) No marked differences resulted in the number of tillers or the number of heads per plant from varying the distance between the rows.

(2) In the plats where the rows were uniformly 4 feet apart but where the plants were thinned to different distances within the rows, the number of heads per plant decreased and the yield increased as the plants were crowded, the thicker stands producing the higher yields.

(3) Counts made of the number of tillers per plant on May 15 and of the number of mature heads per plant at harvest showed that a large number of tillers on the wide-spaced plants failed to produce heads.

(4) The close-spaced plants ripened their grain in 1913 about one week earlier than the wide-spaced plants. This early maturity is particularly important in that it permits the crop to escape injury by the sorghum midge.

(5) Increasing the number of plants per row does not necessarily mean a proportionate increase in the total number of heads or stalks per row.

(6) The weather conditions influence very markedly the number of tillers and branches produced, although the total number of branches and tillers in 1914 about equaled the total number of tillers alone in 1913, when there were but few branches.

(7) In practice, the stand is controlled by varying the rate of seeding rather than by thinning the plants; thick stands are secured by thick seeding.

(8) Thicker seeding than is ordinarily practiced appears to be desirable, in that it results not only in larger yields but also in smaller and more easily handled plant stumps, gives better stands, and insures earlier and more uniform maturity. Where the rows are 4 feet apart, a rate of 5 to 6 pounds of seed per acre is recommended.

(9) It would appear that the close spacing of the plants can be practiced in sections of low rainfall. To offset this increase in the number of plants per row it is necessary only to increase the distance between the rows.

(10) The time the plants are thinned does not seem to be an important factor in suppressing tillers and branches. If the thinning is delayed sufficiently to reduce tillering, there seems to be a tendency for the plants to increase the number of branches.

CANADA FIELD PEAS.

Among the new crops that have been tried at the San Antonio Experiment Farm is the Canada field pea. This crop has been grown since the winter of 1907–8 and has uniformly given such excellent results both as a hay crop and for green manuring that it is the most promising winter forage crop for the San Antonio section. Hay yields equaling and frequently exceeding the yields of oats have been obtained, and the high feeding value of the hay indicates that as a hay crop it is more profitable than oats. It will not stand as

[1] For details of this work see the following: Hastings, S. H. The importance of thick seeding in the production of milo in the San Antonio region. U. S. Dept. Agr. Bul. 188, 21 p., 9 fig., 1915.

severe pasturing as oats, as the plants are tender and would be severely injured if pastured too early. If pasturing is practiced, it should be delayed until the plants are well grown.

As a green-manure crop the field pea is fully equal to cowpeas, and when used as a catch crop after oats or corn it is superior to cowpeas. (See fig. 3.) In the rotation experiments at the experiment farm the field pea was found to be so superior to cowpeas as a green-manure crop that it has been largely substituted for the former crop. When used as a green manure crop, the field pea may be plowed under the latter part of February or early in March, which will allow sufficient time for the land to be prepared for a summer crop of Sudan grass, sorghum, or cotton.

If cut for hay, the field pea should be left somewhat longer, until the earlier pods are beginning to ripen. As there is a great variation in length of seasons of the different varieties, the time of harvesting

FIG. 3.—Canada field peas on plat B6-8, San Antonio Experiment Farm, February 25, 1913. This is a very promising winter forage and green-manure crop for the San Antonio region. (P-4459-W. I. A.)

will depend upon the earliness of the variety, but a mid-season variety like the Golden Vine should be ready to cut early in April.

No experiments have been made with the crop for pasturage, but tests made elsewhere indicate that it is valuable for this purpose when properly handled. Good results have been obtained in more northern latitudes in growing the field pea with a companion crop such as oats. In this region, however, repeated tests have shown that the oats will crowd out the peas. The interest shown locally by farmers in the production of pork indicates that field peas may find a place as a winter pasture to supplement oat pastures.

Field peas should not be planted before the middle or the latter part of November. If planted too early, there is danger that too much growth will be made before cool weather sets in and the plants will be killed back by cold weather in midwinter. If the plants are small, they will withstand 12° or 15° of frost, but if in flower or

approaching this stage only a few degrees below freezing will severely injure the plants.

The peas may be planted in rows about 3 feet apart and cultivated or they may be sown with an ordinary grain drill. The tests made at the experiment farm have shown that when planted with a grain drill seeding from 90 to 100 pounds to the acre better yields are obtained than when planted in rows and cultivated.

A number of varieties have been under trial and during the last winter over 70 varieties were tested. Heretofore the Golden Vine variety has proved to be the best. This is a mid-season variety. There are several varieties among those under trial last season

FIG. 4.—Sudan grass on plat B4-16 just before the first cutting, on June 15, 1914. This is one of the best forage crops for the San Antonio region. Compare with figure 5. (P-5034-W. I. A.)

which give promise of being even more valuable than the Golden Vine. Among them may be mentioned the Kaiser (S. P. I. No. 17006) and the Wisconsin Blue (S. P. I. No. 22049).

SUDAN GRASS.[1]

With the exception of Johnson grass, which is generally considered more of a weed pest than a hay crop, the farmers in the San Antonio section have not had a dependable hay crop. Sorghum has been widely grown for hay and with excellent results, but there are objections to this crop, largely because of the coarseness of the hay and the length of time required to cure it. With the introduction of Sudan grass the outlook was entirely changed, for a grass was found with a feeding value nearly equal to that of timothy hay, without the objec-

[1] Among the publications that indicate the value of the Sudan grass for the San Antonio section are the following:

Piper, C. V. Sudan grass, a new drought-resistant hay plant. U. S. Dept. Agr. Bur. Plant Indus. Circ. 125, 20 p., 6 fig., 1913.

Davis, F. W. Sudan solves problem. Texas Dept. Agr. Bul. 16 (n. s.), 1915.

Youngblood, B., and Conner, A. B. Sudan grass. Texas Agr. Exp. Sta. Bul. 172, 28 p., 7 fig., 1 pl., 1915.

tionable rootstocks of Johnson grass, and yielding a tonnage nearly equal to sorghum. (See figs. 4 and 5.)

The season of 1914 completed the fourth year that Sudan grass has been under trial at the experiment farm. The average yield from this crop for the past three years has been 6.22 tons per acre, and the average yield from Sumac sorghum similarly grown has been 7.03 tons per acre. It is probable that during favorable seasons, like those of the past three years, Sudan grass will equal sorghum in yield. However, it is so superior in other respects that it may be expected to replace sorghum as a market hay crop. It is much more easily cured, owing to the fineness of the stalks and leaves.

FIG. 5.—Sumac sorghum on plat B4-13. Until the introduction of Sudan grass sorghum was the chief hay crop of the San Antonio region. Compare with figure 4. Photographed June 15, 1914. (P-5039-W. I. A.)

If Sudan-grass hay during the summer is left five or six days it is well cured and can be hauled to the stack without fear of its being damaged. The finer quality of the hay results in the crop being more easily handled and in there being less waste in feeding. It is much earlier to mature than Sumac sorghum, which is the standard variety for this section. Sudan grass is ready for the first cutting in 70 to 85 days from planting in the spring. During favorable seasons or under irrigation three cuttings may be obtained.

At the experiment farm the best results have been obtained by seeding Sudan grass with a grain drill, using from 20 to 25 pounds of seed to the acre. Good yields have been obtained by planting in rows and cultivating, but the added cost of production and the somewhat coarser quality of hay seem to make this method less desirable than seeding with a grain drill.

OAT-PASTURING EXPERIMENT.

The early planting of oats, sometimes as early as September, after such early-maturing crops as corn is frequently practiced. This is

done to supplement the native pasture, which is rather scarce and not infrequently very poor during the fall. In favorable seasons oats make a very luxuriant growth during the early fall and a field will carry several times as much stock as the same area of native pasture. Little is known regarding the value of the pasturage, or the effect upon yield of grain and hay, or upon how late the oats may be pastured without seriously affecting the yield.

In the fall of 1913 an experiment in pasturing winter oats was undertaken, for the purpose of determining the effect of pasturing oats for varying lengths of time upon the development of the oat plant, the yield of straw and grain, and at the same time to determine the value of the pasturage furnished.

Appler Rustproof oats were planted with a grain drill on field C5 on October 16, 1913. The oats were seeded at the rate of about 80 pounds per acre. The soil was in excellent condition at planting time and a good stand was secured. The season was very favorable for plant growth, so that the oats were ready to be pastured by November 25, but owing to wet weather at the time it was not considered advisable to start pasturing until December 9. At first two cows per acre were used, but it was found that these could not consume all the material available, so on December 23, two more cows were put on. During December and the greater part of January good pasturing was furnished, but after the latter part of January, the plats were very closely grazed and somewhat overpastured. It seems that for a time under similar conditions four cows per acre can be pastured, but as the weather gets cooler the oats make little growth and this number will have to be reduced or the crop will be injured. Table VI gives a summary of the experiment.

TABLE VI.—*Yields of oat hay and grain in the oat-pasturing experiment at the San Antonio Experiment Farm in 1914.*

Plat.	Pasturing period.	Height at maturity.	Yield per acre—	
			Straw and grain.	Grain.
		Feet.	*Pounds.*	*Bushels.*
1	Not pastured	3.7	2,856	17.5
	Dec. 9, 1913, to—			
2	Jan. 1, 1914	3.8	2,728	17.3
3	Jan. 20, 1914	3.0	1,536	9.0
4	Feb. 10, 1914	2.6	752	5.3
5	Mar. 1, 1914	2.0	432	2.8

Not much importance should be given to the yields from plats 3, 4, and 5, as these were cut later than Nos. 1 and 2, and owing to unfavorable weather conditions were overripe and badly lodged. They therefore appear in the table somewhat less favorably than they should. It is possible from this preliminary experiment to give only tentative conclusions as follows:

(1) Oats can be pastured up to January without seriously injuring the hay crop. It is advisable, therefore, to plant early in the fall, at least as early as the first of October.

(2) Pasturing the oats severely in the winter and early spring has a very marked effect in reducing the yields of hay or grain, but this in turn may be offset by the returns from the pasture.

CORN AND COWPEA EXPERIMENT.

An experiment to determine the effect on the yield of corn of increasing the distance between rows and planting a row of cowpeas between was conducted. The experiment included three plats, each plat with five 264-foot rows of corn. In plat 1 the rows were planted in the ordinary manner, i. e., they were 4.1 feet apart and the plants were spaced to about 2 feet in the row. In plat 2 the corn rows were 6 feet apart, the plants being spaced 2 feet in the row and a row of cowpeas planted in between the corn rows. On plat 3 the corn rows were 6 feet apart, the plants being spaced to 2 feet in the row, but without the cowpeas. Laguna corn and Whippoorwill cowpeas were used. The corn was planted on March 25 and the cowpeas on May 9, the corn being about 2 feet high at the time. Table VII gives a summary of the results from this experiment.

TABLE VII.— *Yield of corn in the corn-cowpea experiment at the San Antonio Experiment Farm in 1914.*

Plat.	Distance between rows.	Plants per acre.	Yield per plant.	Yield per acre.
	Feet.		*Pounds.*	*Bushels.*
1, corn only	4.1	4,728	0.60	40.5
2, cowpeas and corn	6	3,173	.70	31.9
3, corn only	6	3,202	.67	30.8

The cowpeas in plat 2 were harvested on November 10. They made a good growth after the corn was ripe. The hay yield was at the rate of 1,328 pounds per acre.

Table VII shows that the corn in the 4.1-foot rows gave an appreciably higher yield per acre than the corn in the 6-foot rows, whether cowpeas were planted between the corn rows or not. There was practically no difference in yield between the two plats where the corn rows were 6 feet apart. It appears that this season the cowpeas had no detrimental effect on the corn when compared with plat 3. Comparing plat 1, planted in the ordinary way, with plat 2, in 6-foot rows with the cowpeas between, the yield from plat 1 was nearly 10 bushels greater than plat 2. It is probable that the value of the cowpea hay harvested from plat 2 was equal to or greater than the value of the 10 bushels of corn. The fact that the cowpeas did not affect the yield of corn is to be expected in an exceptionally favorable season like that of 1914. During seasons of scanty rainfall it is highly probable that the cowpeas would have a considerable effect unless ample space were left between the rows.

HORTICULTURAL EXPERIMENTS.[1]

The late spring frost occurring on March 23 so seriously injured the fruit crop, more especially the peaches and plums, that the results from this work were very unsatisfactory. Persimmons, figs, citranges, and jujubes were the only trees that fruited to any extent. The Rusk variety of the citrange fruited heavily this season and has demonstrated its adaptability to the section. (See fig. 6.)

FIG. 6.—Rusk citrange in fruit in orchard A3. This is one of the promising new fruits for the San Antonio section. Photographed October 6, 1914. (P-5391-W. I. A.)

Additions were made to the list of fruits already under test. There are being grown at this time 63 varieties of peaches, 37 varieties of plums, 20 varieties of grapes, 16 varieties of persimmons, 14 varieties of apricots, 10 varieties of almonds, 6 varieties of pears, 2 varieties of nectarines, 2 varieties of quince, and 2 varieties of prunes. Besides the fruits mentioned above, a few plants each of olives, pomegranates, citranges, pistaches, jujubes, walnuts, cherries, and plumcots are being grown.

Approved:
WM. A. TAYLOR,
Chief of Bureau.

JUNE 24, 1915.

[1] See also Hastings, S. H., and Blair, R. E. Horticultural experiments at the San Antonio Field Station, Southern Texas. U. S. Department of Agriculture, Bulletin 162, 26 p., 8 fig., 1915.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1915